

SWOT Analysis for Iran's Wind Farms

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Abstract

Renewable energies are having a growing share of power generation across the globe mainly in the developed and industrialized nations of the world with intentional benefit on the environmental issues. Although, Iran is a rich country in terms of wind energy, however, compared to US, China and European countries, little has been done on utilization of renewable energies targeted for electricity. Potential energies such as high speed wind tunnels, solar energy, geothermal and valuable biomass sources of energy are at preliminary stages and their share of total power generation is still negligible and does not exceed 0.6%. Whereas, design and construction of wind farms is economically feasible due to reasonable price of equipment and abundance of cheap sources of renewable energy, SWOT analysis is conducted in order to unveil the reasons underlying the slow pace of development of wind farms in Iran. The analysis is intended to draw a roadmap and specify the nation's macro policies.

This study applies SWOT analysis in wind farms and reveals the very fact that abundance of inexpensive fossil fuels constitutes one of the most decisive factors why wind farms remain undeveloped in Iran and instead priority is given to the thermal power plants which are both cheaper and more reliable compared to wind power generation. Other significant factors considered by private investors and companies in the renewable energy sector, is the economic impediments and governing rules and regulations. In this study, financing procedures and change of law that would facilitate removal of the standing obstacles. Although, the Middle Eastern countries possess fossil fuel resources but at the same time suffer from shortage of potable water as well as non-development of wind farms. This study in general can be useful and practical in these countries.

1- Introduction

A growing demand for energy and prospects of exhaustion of conventional energy sources lead to an increased interest in alternative energy sources in Iran. In the future, Iran must have a sustainable, affordable and environment friendly energy supply. The limited amount of natural resources and environmental pollution are major reasons for expanding the use of renewable energies, so conventional fossil fuels gradually will be replaced by renewable energies. The negative aspect of import dependence of the energy resources led to the energy supply security threat concept and renewable sources are designated as the remedy for this threat. The development of renewable energy is of utmost importance to the implementation of Iran's Sixth five-year plan and obligate in COP21.

Renewable energies have received growing attention all over the world recently. Since renewable energies help in decreasing import based energy dependency, diversifying energy portfolios and contributing sustainable development. Many countries, like USA, China, India, Turkey, Egypt and Pakistan began to seek ways to promote their renewable energies and increase the share of renewable energy in their energy mixes[1]. From the fluctuation of

global oil prices, imbalances of international energy trade to environmental concerns, there are many factors forcing Iran to promote renewable energies. Promoting the use of renewable energy sources enables greater diversification of supply sources and creates conditions for the development of distributed energy based on locally available resources. Renewable energy usually consists of small production units located close to the consumer, which improves local energy security and reduces transmission losses, in addition to Iran's energy demand is increasing rapidly because of the growing rate of investment after sanctions, therefore growing industrialization, technological improvements and development. To achieve sustainable development, environmental organization has set the following mission according to Iran obligate in COP21(Dec.2015) for decreasing 8% of air pollution till 2030, that share of power minister is accomplishment of 7500MW renewable energies in this duration, it is Iran mission to ensure efficient, effective, safe, and environment-sensitive use of energy and natural resources.

The major renewable energy sources of Iran are hydropower, wind, solar energy. These sources are utilized in many areas especially for generating electricity and heating purposes. In this study, evaluation of these renewable energy sources, especially wind energy in terms of increasing their contribution in electricity generation is considered. Therefore, evaluation and planning of renewable energies for electricity generation will provide important guidance for achieving sustainable development. Identification of the best renewable energy source to invest money is an important issue since this decision will affect future energy policies of Iran.

In order to evaluate the major renewable energies of Iran, a brain storming is prepared based on literature review and send out to 112 experts who are academicians and wind farms professionals from government and private sector. These experts are selected by considering their experiences and previous studies on wind farms, technologies, market conditions, and policies. In this study, experts are asked to evaluate wind energy sources with respect to two main criteria; energy objectives and environmental objectives. An extended literature review is conducted and criteria used for energy objectives and environmental objectives are developed based on the literature review. Then experts' responses to the survey are evaluated using SWOT analysis.

2- Analysis Procedure

2-1- SWOT Analysis

SWOT analysis is a structural planning method intended to assess strength, weakness, opportunities and threats residing in a given high risk new project or business. SWOT analysis application covers the following areas:

- Discovery of new solutions to the residing impediments
- Identifying impediments that restrict the project
- Decision making for directing the project towards more efficiency
- Unveiling probabilities and restrictions for change
- Reviewing and revising plans and programs for the purpose of gaining access to project's most suitable direction

SWOT analysis is significant since it can portray the above items for the elaboration of future steps of the organization's strategic plan for winning objectives. The SWOT analysis already conducted was analyzed and examined in detail by four working groups. These working groups comprised relevant COPs(committee of professional) from the ministry of energy, New Energies Organization of Iran (SUNA), ministry of industries, investment companies, members of parliament and university professors in the order of the table [1][2][3]:

Table 1: SWOT committee of professional

COPs	No. of institutions	No. of experts	Experts' education status		Average expertise rate(year)
			BS/MS	PhD	
MAPNA renewable energies	4	11	10	1	12
SUNA: wind farms section	8	14	6	8	15
Parliament's energy commission	11	22	14	8	16
Association of Iran's wind power plants	21	21	9	12	19
Non common & Ave.	31	44	28	16	16

2-2- Conducting SWOT for Wind Power Plants

2-2-1- Iran's Wind Power Plants' Strengths

- Free sources of wind energy
- Independent from fuel and water for the generation of electricity
- Low O&M costs compared with other power plants
- Minimum land area requirements (on spots)
- According to studies of the ministry of energy, that reported, all wind farms in Iran are capable of handling 3MW turbines [4]
- Quick and simultaneous installation of turbines
- Micro sitting conducted by SUNA
- Majority of wind farms in Iran have been located in plain areas thus minimizing the cost of erection and execution[5].
- Infrastructures necessary for the implementation of projects such as access roads and power grid exist for most of wind farms.
- Availability of the choice of off-grid and on-grid installation of wind turbines.
- Iran's border line with the Persian Gulf and Oman sea is over 2000 kilometers. These areas together with the Persian Gulf islands are generally not connected to the power grid and therefore, lower cost on-shore turbines installed in these areas can offer the advantages of off-shore turbines at no additional costs [6].
- Whereas, south of Iran is one the world's dry regions, desalination of sea water can be a priority in this region. Wind turbines can provide sources of energy required for desalination units.
- SUNA guaranteed purchase of wind power at reasonable feed in tariff for 20 year.
- SUNA will pay 30% more to feed in tariff if investor used Iranian turbines.
- Buy-back laws exist for the purchase of wind power at reasonable rates[7].
- Provision of financial sources out of excessive tax levied on over consumption (rural consumers are exempt).

- According to Falcon Mark and the UN indices, Iran is experiencing water tension; therefore, provision of water is a high cost process. Wind turbines need no water for cooling. The average water consumption in the power plants in Iran, is 1.05 m³/mwh [5][8].
- Whereas, Iran power plants generate 262 TWh of electricity, they require 275 Mm³ of water annually. If wind power generation constitutes only 1% of this figure, 2.75 Mm³ of water is saved each year [5].
- Each 100 MW of electricity generated by wind power plants saves consumption of 90 million liters of gasoil.
- Further supports by the environment protection organization for the reduction of pollutants and emissions. Each 100mw wind plant capacity prevents production of 240 tons of CO₂ emissions per year, that is what otherwise 50 million trees would do. According to a report released by the World Bank, the annual cost of pollution in Iran is US\$1810 million and development of wind farms will certainly reduce this rate.
- Further support by the ministry of health and treatment aimed at reducing the cost of public health and treatment is noteworthy.

2-2-2- Iran's Wind Power Plants' weakness

- Higher Capex. (capital expenditure) compared to thermal power plants that have the highest share of generation of electricity.
- Rate of generation of wind farms during the year ranges between 35% to 55% only and the rest should be covered by the grid. Where DG wind turbines are utilized, the generated electricity should be stored in a variety of fashions.
- Wind power plants are developed only in specific wind tunnels and therefore, at times additional transmission cost should be considered [9].
- The contract for the guaranteed purchase of electricity is new and payment guarantees have not been proved yet.
- The possibility does not reside in wind farms to build high rise installations.
- The experience of application of renewable energy projects in Iran is restricted; therefore, given the complicated nature of such projects, chances are low for the efficient management of such businesses.
- Whereas, the volume of operations and engagements pertaining to renewable energies is expected to increase in the future, lack or shortage of skilled manpower in the market doubles this weakness.

2-2-3- Wind Farm Opportunities in Iran

- Iran is located on the seasonal wind belt. This has facilitated development of numerous wind farms here.
- Expansion of small scale wind turbines has served to be effective in giving way to the culture of developing wind farms.
- The ministry of energy announced in 2015, it plans to generate 7500 MW of electricity from renewable sources of energy till 2030 (with the exception of hydroelectric plants) which will meet 7% of Iran's power requirements. This indicates

that the government pursues encouraging plans for the expansion and development of renewable sources of energy in the country.

- Engagement of large Iranian companies in the area of manufacture of main wind turbine parts such as blade, tower, control systems, etc. will allow the industry to compete in the world market of wind turbines in the near future.
- CDM (clean development mechanism): in accordance with the Kyoto protocol, the Iranian companies that generate emission free electricity can receive CER (Certified Emission Reduction) from the UN. Holders of this certificate are entitled to receive funds from the UN in return for the generation of emission-free power.
- Such countries as Pakistan, Azerbaijan and Georgia that are host to rich wind farms form rewarding overseas markets for the Iranian players of the industry.
- Relying on modern technologies and benefiting from the services rendered by their specialists, Germany, Denmark, US and China lead the wind farm industry. Iran, however, has proved to be the leading producer of thermal power plants in the Middle East. In addition to thermal power plants, Iran's expert company has undertaken to manufacture and construct the Middle East's largest wind farms relying on the following advantages:
- Large companies engaged in the power generation industry have built confidence in the suppliers of technology, consumers, contractors and government bodies. Such a confidence is on the building in the wind farm market as well.
- Integrated management of production and execution of all components of wind farms within a manufacturing unit can significantly impact pace of production and end user price.
- The potential that resides within large groups to finance wind farm projects is a unique opportunity for the financing and development of wind farms.
- The National Development Fund's of Iran interest rate is reasonable. Even if the loan is granted, it covers less than 75% of the project cost.

2-2-4 Wind Farm threats in Iran

- Whereas, wind power plants require procurement of expensive equipment and as a result huge financing and private companies are still not prepared to accept the relevant risks, the risks associated with the early projects need to be covered by the government.
- Whereas, a wind farm is constructed in an extensive area, companies tend to purchase the land area surrounding each turbine separately and that makes the process time wasting and complicated.
- Generation of power from renewable energies in Iran is a new industry and therefore relevant laws and regulations remain undefined.
- Problems associated with hard currency exchange since, majority of invest in US dollars or Euros, however, their returns and incomes are in the local currency.

3- Analysis of SWOT Factors

For the purpose of better analyzing and examining economic issues and laws governing wind farms, they are placed in three categories in the following order[10]:

3-1- Procedure for the financing of wind farms

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According to article 139 of the fifth development plan law, in order to build the infrastructure required for the manufacture of the equipment used in the solar and wind power plants as well as development of clean energies and increasing the share of generation of such energies in the nation's energy generation basket, the government is authorized to extend support for the private and cooperative sectors through administered funds and facility interest subsidy, hence, providing the grounds for the generation of up to 7500 MW of wind and solar energy in the course of the fifth plan. Therefore and whereas, this industry is a capital intensive one, wind farms in particular, and private sector's restricted financial sources, the financing of the said projects should, in addition to the cash equity of shareholders, be covered through other means in the following order:

3-1-1- Low interest rate facilities

Whereas, bank interests in Iran are very high and return of loan is short term and the interest rates of such loans exceed the project's rate of return, investors are not attracted by bank loans.

3-1-2- Receipt of facility from the National Development Fund

The National Development Fund's interest rate is reasonable and majority of investors do their best to use this fund for financing of a project, however, the fund allocates little financing to renewable energies and for that matter, receiving loan from this fund is time consuming and projects rarely have the chance to receive a loan from this fund. Even if the loan is granted, it covers less than 75% of the project cost.

3-1-3- Overseas Financing

Financing of projects utilizing overseas financial sources is attractive for local and foreign investors due to low rate of interest compared with local banks. In recent years, however, due to sanctions and impediments in the way of transfer of money to Iranian banks and high risk of investment in Iran, overseas financial sources refuse to grant loans to wind farm investors.

3-1-4- Facilities granted by the Ministry of Energy out of collection of Consumer Tax

According to paragraph 69 of Iran's 2015 budget law, the government is authorized to levy extra taxes on excessive consumption of electricity and allocate these funds for the development of renewable energies. As of April 2013, this law urges the ministry of energy to collect an additional IRR30/kwh in electricity fee from subscribers (rural household consumers are exempt). The funds thus collected will be injected into development and maintenance of rural power networks. IRR30 is scant and only part of it is allocated to the development of wind energy. Development of wind power plants in Europe has proved to be a progressive trend in the past twenty years. The reason underlying such a growth is electricity tariffs. Electricity tariffs are high in Europe, Germany and Denmark in particular. Incomes resulting from higher electricity tariffs are injected into renewable energy projects. Figure 1 displays electricity tariffs in Europe and Iran in 2015 [11][12].

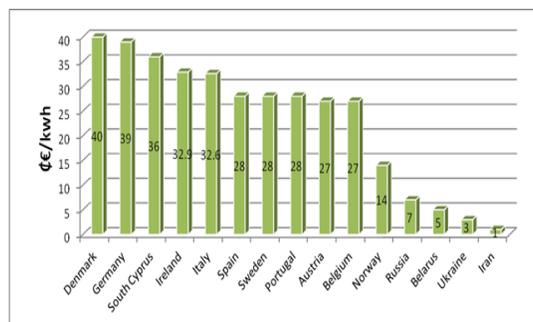


Figure 1: Comparison of electricity tariffs in Europe and Iran

The cost price of each KWh of electricity in Iran is IRR7850 of which IRR7000 is fuel cost and IRR850 is spent for the conversion, transfer and distribution of energy. This is under circumstances that the ministry of energy charges consumers only IRR500 for each kwh of energy and pays IRR7350 in subsidies which could easily be allocated to the development of power generation from renewable energies. The government levies a scant IRR30/kwh in tax on consumers of electricity for the development of renewable energies. Thus, the ministry of energy provides consumers with the cheapest electricity tariffs compared to the European states. The reason is obvious, the one of the largest fossil fuel resources exist in Iran which makes construction of thermal power plants quite reasonable compared to renewable sources of energy. That is why, Iran is ranked among the world's ten top countries in terms of excessive consumption of electricity and no government has managed to curb this trend [13].

3-1-5 KYOTO international pact

KYOTO is an international pact which aims to reduce release of green house emissions and global warming in recent decades. In 1997, industrialized nations pledged, under this pact, to reduce by 5% the volume of their green house emissions in ten years and grant financial assistance to the developing states with regard to application of renewable sources of energy such as solar and wind energies. Whereas, Iran is on the list of the developing states, several projects in Iran within the framework of the Kyoto pact have been introduced to the UNFCCC of which majority of wind farm projects have been approved. These projects receive financial assistance from the UN in return for the generation of energy and non-release of pollutants. This amount is currently €15 per ton CO₂ has been reduced significantly compared with the previous year's [14].

3-1-6- Procedure for securing the special fund's capital

Another attractive method is allowing the investors to have a share of the profit as a result of the progress of projects. In this manner, concerns about inflation rate are subsided, for growth of the company's asset value can notably cover inflation.

3-1-7- Procedure for providing capital for lease Sokuk bonds

Sokuk generally implies Islamic financial tools. In this mechanism, physical-asset-based bonds are issued. The owners of bonds are in fact considered owners of the asset. The owners

of these bonds own a portion of the asset that has been assigned in compliance with the lease contract.

3-2- The cost of execution of wind farms

The cost of construction of wind power plants in Iran is 20 to 30% higher than this cost in countries that own the technology. This higher cost is the result of shortage or absence of local producers of turbines and lack of proper economic and political ties with the owners of technology. Concurrent with the adoption of a new approach by the government in recent years in favor of interacting with the owners of wind farm technology and contribution of potential local companies to the manufacture of MW turbines in Iran, one can expect that the EPC cost of wind farms will fall quite reasonably in the near future.

3-3- Contracts for the purchase of electricity from the wind farms

3-3-1- Guaranteed purchase of electricity

The government purchased wind farm generated electricity at an average rate of IRR620 from 1990 to 2009. Since 2009 till 2012 this figure was doubled and reached IRR1240. Investors were first attracted by these rates, however, with the rise of foreign exchange rate, the interest subsided sharply. In late 2012, the government increased the rate to IRR1863.2. Even this newly introduced rate failed to attract investors. In mid 2013, foreign exchange rate was relatively stabilized and purchase of electricity was guaranteed on the basis of fossil fuels and for the first time in 2013 the government approved IRR4420 for each kwh of electricity generated by renewable energies, IRR4630 in 2014 and IRR4970 in 2015. Main investors were firmer this time to invest in renewable energy projects. Figure 2 illustrates purchase price of electricity in the last 20 years[15].

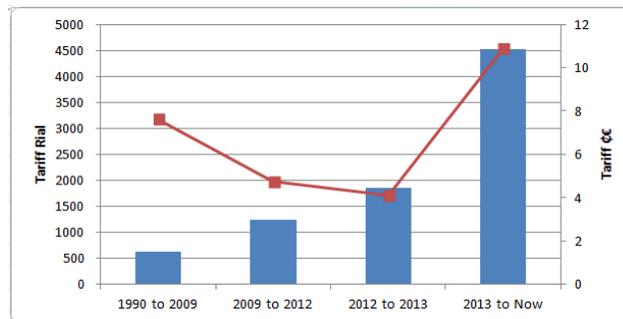


Figure 2: Electricity purchase price since 1990 (IRR and €)

As is evident, despite the hike in Rial based price of electricity in the last two decades, the equivalent hard currency price of it has declined. This is under circumstances that hard currency constitutes major portion of the cost of construction of a wind farm since no active local producers have had a share at this stage. That reveals that the purchase price of electricity has declined since 1990 till 2012. In 2013, however, this rate has registered a growth of 250% compared to a year before that, and increase again in 2014. This guaranteed rate covers a period of 20 years which changes annually proportionate with the rate of inflation and the procedure for the purchase of electricity by the ministry of energy.

3-3-2- Buyback Contract for Renewable Energies

Another law in support of investors in the area of renewable energies (2014) includes article 6 of the executive bylaw of paragraph 19 of 2013 budget law of the ministry of energy that authorizes the government to conclude buyback contracts -through Tavanir Co.- with all investors who apply for constructing renewable power plants. According to this contract, the ministry of oil provides renewable energy investors with the equivalent amount of unused fuel that would otherwise be consumed in a thermal power plant to generate the same amount of electricity produced in a wind farm in two years. The ministry of oil is obligated to deliver to the investor, the amount of the saved liquid fuel within maximum one month after approval by the ministry of energy.

This is a win-win contract for both investors and government, for investors sell the generated electricity at higher rates and a major portion of their investment is returned during the course of the two year long contract. On the other hand, however, the ministry of energy purchases electricity generated by power plants at real rates and bears no additional costs. Meantime, there will no longer reside any concerns regarding supply of fossil fuel to power plants nor any emissions will be released.

4- Conclusion

Although Iran is located in one of the best places in the world regarding for wind corridors and sun shining; but developing in renewable energies should be considered close to nothing. This survey shows the main reason for lacking of renewable energies development must be found in cheap fuel accessibility in Iran; making renewable energies prices not be able to compete against the price of electricity generated by thermal power plants. As a solution for bringing the renewable energies into a continuous stream of development some verity of supports should be attached into this development such as long term buy agreement, subsidizing related investment, tax exemptions, rendering loans with low interest rates, and supporting internal related manufacturing. The source of this supports should be come from lowering the subsidies of electricity price from other sources (about \$42 Bln. per annum); apparently, the lower price for electricity produced by thermal power plants and encouraging for more demand will allocate the economic resources not in to the renewable energies developments. Finally, the studies of succeeded countries regarding renewable energies development and trying to customize the same plans in Iran and hopefully emerging new government in Iran for expanding political and international relationships and also new approach of Iran's government regarding renewable energies shows effective steps for developing renewable energies in Iran's tomorrow.

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